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which the index *f* has been traversing, was invented by Mr. Hardy in making the model for the Society. The instruments, therefore, which were constructed before that period are without this very useful addition.

No. XVI.

STRIKING PART OF A QUARTER CLOCK.

The sum of TWENTY GUINEAS *was this session given to Mr. J.* AITKIN, *55, St. John-street, Smithfield, for his improvements in the Striking Part of a Quarter Clock. A model of the invention has been placed in the Society's repository.*

THE parts of a clock concerned in striking the hours and quarters have generally been very complicated, and, of course, liable to be put out of order. Mr. Aitkin, by a novel and very ingenious adaptation of each piece to different uses, has succeeded in greatly reducing their number, as will appear by the following detailed description.

Plate XIII. is a front view of the plate and motion work of a quarter clock, having the dial-plate removed.

Plate XIV. represents a view of the front and upper edge of the several parts in detail.

The same letters refer to the same parts in both plates.

a a is the front plate, or part of the frame to which the motion work is attached.

The train or wheel work is nearly similar to that of the common quarter clock; the diameters of the wheels and their pinions are represented by the dotted circles (that is to say, their diameters at the pitch lines), and the number of teeth in each marked upon them.

The three lowest and largest dotted circles A F K represent the diameter of the barrels or cylinders which contain the springs or maintaining power, and each of them gives motion to three respective trains of wheels and pinions; the spring A gives motion to the first or fusee wheel B; the wheel B works into the pinion *b;* the second or centre wheel C works into the pinion *c;* the third wheel D works into the pinion *d;* the fourth or escape wheel E acts on the pallets *e;* and the pallets give motion to the pendulum, which regulates the time.

The spring F gives motion to a second train of wheels and pinions, which actuate the striking part of the quarters; G the first or fusee wheel working into the pinion *g;* the second wheel H is fixed on the axis of the pinion *g*, and works into the pinion *h;* the third wheel I is fixed on the axis of the pinion *h*, and works into the pinion *i;* the fourth wheel J is fixed on the axis of the pinion *i*, and works into the pinion *j;* on the axis of the pinion *j* is placed the fly *e*, which regulates the time of striking the quarters; the second wheel H also works in the barrel wheel P, on the axis of which is fixed a barrel or cylinder *f;* on the surface of the barrel are fixed a number of short pins *k k*, which act against the tails of the hammer *p p* which strike the bell *a;* any number of hammers and bells may be fixed at pleasure, if the clock is intended to chime instead of merely to strike; for which latter only one bell is required.

The spring K gives motion to a third train of wheels and pinions, which actuate the striking part for the hours; the spring K gives motion to the first or fusee wheel L, which works into a pinion *l*, on the axis of which is fixed the second wheel M, which works into the pinion *m*; on the axis of the pinion *m* is fixed the third wheel N, which works into a pinion *n*; on the axis of the pinion *n* is fixed the fourth wheel 0, which works into a pinion *o*; on the axis of which is placed the fly which regulates the time of striking the hours.

On the axis of the centre wheel C, and on the front of the plate *a a*, &c. is fixed a wheel R, which works into a wheel S, of equal numbers of teeth; the wheel S turns on a stud *q*, fixed on the front plate *a a*; on the face of the wheel S are fixed four pins, or studs, $r\ r''\ r''\ r'''$ the use of which will be hereafter described. There is also on the end of the socket of the wheel S fixed a minute pinion *s* of six teeth, which works into the hour wheel T of seventy-two teeth; the hour wheel turns on the axis of the centre wheel C.

On the face of the hour wheel T is fixed a socket which passes through the dial-plate, and on the square at the end of the socket is fixed the hour hand *t*; on the end of the axis of the centre wheel C, which passes through the socket of the wheel T, is fixed the minute hand *u*; to the face of the wheel R is fixed the quarter snail *v*, the edges of which are formed of five concentric parts, of different radii, $v\ v'\ v''\ v'''\ v''''$, the use of which will be hereafter described. On the face of the snail *v* is fixed a pin *w*; consequently, when the snail *v*, &c. are turned round, the pin *w* will act against one of the teeth of the star wheel U, and cause it to turn one-twelfth round, when it will be detained by the action of a bent spring *x*, which acts against the points of two of the teeth.

On the face of the star wheel U is fixed the hour snail

V, the edge of which is formed into steps of twelve concentric parts of different radii, marked 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12; the star wheel and snail turn together on a stud *y* affixed to the front of the plate or frame *a a;* W is another stud, which is also fixed in the plate *a a*, and on which turns an hour rack X ; in the tail or lower end of the rack X is fixed a pin, or stud *z*, which tends to drop against the edge of the snail V, by a spring *x*, acting against the inside of one of the arms of the rack. The upper edge of the rack is formed into fourteen triangular notches or teeth, into which drops a catch or detent Y: the catch Y turns on a stud 13, affixed to the plate *a a*; in the back part of the tail of the catch is fixed a stud or pin 14; on the other end of the catch Y, and on the back part, is a projecting piece or detent 15, which passes through an oblong hole 16 in the plate *a a*, and against which butts or rests a stud or pin 17, which is fixed in the rim of the wheel O ; that is to say, when the catch Y is in the notch 1′ the notch 1′ being cut deeper than the rest, it admits the catch, together with the detent 15, to drop lower than when in any other of the notches; and when in that situation, the pin 17 will rest against it; but should the catch Y be in any other notch the detent 15 will be raised above the pin 17, and the wheel O will then be at liberty to turn round. On the end of the axis of the wheel N is fixed a gathering pallet 18, which acts against the side of one of the teeth of the rack X, and causes the rack to move forward one tooth every revolution of the wheel N, when it will be detained by the catch Y, which drops into one of the notches before the pallet 18 clears the point of the tooth of the rack : if the catch Y is raised till the detent 15 rests against the upper side of the hole

16, a pin or stud 19, which is fixed in one of the arms of the wheel O will also butt against the detent 15, and prevent the wheel O from turning round; the use of the pin 19 will be described hereafter. Z is the quarter rack, which turns on a stud 20, the stud is affixed to the plate *a a*; 21 is a spring, the upper end of which is also fixed to the plate *a a*; the lower end acts against the inside of one of the arms of the rack Z, and tends to press the rack towards the centre of the clock; on the upper edge of the rack are six triangular notches or teeth, in which acts the end of a catch or detent 22; 23 is a stud affixed to the front plate *a a*, and on which turns the catch 22 (see figs. 1 and 2, plate XIV., which are views of the front and upper side); on the socket, and on the front side of the catch is fixed an arm 24, and in the other end of the arm is a slit in which a trigger 25 is inserted, having a pin passing through them which forms a joint; the motion of the joint is limited, that is, the point a' of the trigger 25 will turn to the dotted position a'', when the shoulder of the joint of the trigger will butt against the end of the slit in the arm 24, which limits its motion: on the upper side of the arm is fixed a spring 26, the end of which acts against the upper edge of the trigger and tends to keep it straight with the arm 24. On the lower end or tail of the rack Z, and on the back part is fixed a stud or pin 27, which drops against the edge of the quarter snail *v*, when the catch 22 is raised above the teeth of the rack Z. 28 is another gathering pallet, fixed on the end of the axis of the wheel I, and which acts in the teeth of the rack Z, and causes it to move forward one tooth each revolution of the wheel I, and is detained by the catch 22, which drops into a notch two teeth a head of the pallet, before the pallet clears the point of the tooth; it must be observed, that when the pallet has cleared the point of the fourth tooth (as represented in the engraving), the other end or tail 29 of the pallet butts or locks against a pin or detent 30, which is fixed in the front of the rack Z, and which prevents the pallet 28 from turning any further; it must also be observed that when the pallet 28 is in the same position, it is acting against the eccentric side of a lever 31, which assists in elevating the catch 22 at a certain period;the lever 31 turns on a stud or centre 32 (which is behind the catch 22, and is fixed in the plate *a a*); near the upper edge, and on the front side of the lever 31, is fixed a stud 33, which projects forward beneath the lower edge of the catch 22, therefore, as the pallet 28 turns round, it will elevate the end of the lever, together with the stud 33, which will also raise the catch 22; but this will only take place the first revolution of the pallet 28, after the detent 30 has been removed; for the instant the point of the pallet 28 clears the end or point of the lever 31, that part of the lever drops below the orbit of the pallet, and the side 34 of the lever butts against a pin 35 (which is fixed in the plate *a a*), and will rest in that position till the pallet 28 has gathered up the three first teeth, and begins to act on the fourth tooth of the rack Z; then as the rack advances forward, a pin 36 (which is fixed in and projects on the back part of the rack Z) acts against the eccentric or lower edge 37 of the lever 31, and raises its point within the orbit of the pallet 28; consequently, when the pallet has just cleared the point of the fourth tooth of the rack Z, it will then be in a position ready to act on the point of the lever 31, as shown in plate XIII.

38 is a tumbler or lever, which turns on a centre 39, and

which is fixed in the plate *a a;* 40 is a spring, one end of which is also affixed to the plate *a a,* and the other acts against the tail 41 of the tumbler, which tends to keep the upper edge of the arm 38 against the stud 14 which is fixed in the back part of the tail of the catch Y, as already described; 42 is another pin or stud which is fixed in and projects on the back part of the rack Z, and acts against the edge of the arm 43 of the tumbler; now suppose the notch *viii* in the quarter snail were turned opposite the stud 27 in the tail of the quarter rack Z, and the catch 22 raised out of the notch, the spring 21 will cause the end 44 of the rack Z to strike the upper edge 45 of the tail of the catch Y, which will depress it, till the detent 15 in the other end of the catch is raised against the upper end of the hole 16, and when in that situation the stud 14 in the tail of the catch Y, will have slid past the corner of the side 38 of the tumbler; the action of the spring 40 will then cause the side 38 to strike or but against a pin 46 which is fixed in the plate *a a*; and when in that situation the stud 14 will be resting against the end of the arm 47 of the tumbler, which will prevent the catch Y from dropping into the rack X, till such time as the pallet 28 has gathered up three of the first teeth of the quarter rack Z, and when in the act of moving the fourth, the stud 42 in the rack Z will be drawn up against the edge of the arm 43 of the tumbler, and when the pallet is just clearing the point of the fourth tooth, the stud 42 will have pulled round the arm 43 of the tumbler together with the spring 40, till the end of the arm 47 has slid past the stud 14; then the catch Y will by its gravity drop into the rack X, and the stud 14 will slip past the corner and along the side 38 of the arm of the tumbler to the situation as represented in plate XIII.

Eight pins or studs 48, are fixed in the rim of the wheel M, which act against the under-side of the tail of the hammer 49; therefore, as the wheel turns round, the stud keeps raising the tail of the hammer till it passes beneath it; then the spring 50, which acts against the lower part 50′ of the hammer 51, causes the hammer to strike the hour bell 52, which will be repeated each revolution of the pallet 18; therefore every tooth of the rack X, which the pallet gathers up, will cause the hammer to strike the bell once. It must be farther observed, that when the hour catch Y is in the notch *i*, the stud *z* is raised above the part 1 of the hour snail V, equal to one of the steps of the snail, consequently, when that part of the snail 1 is turned opposite the stud *z* (in the tail of the rack X) and the catch Y be raised out of the deep notch 1′, the stud *z′* will drop against the edge, or part 1 of the snail V, the rack X will be moved one notch forward, the catch Y will drop into the second notch of the rack, the detent 15 will be raised above the pin 17 of the wheel O, which will then be at liberty to turn eight times round, which will cause the wheel N, together with pallet 18, to turn once round, the wheel M will turn one-eighth round, which will cause the hammer to strike one: then the catch Y will drop into the notch 1′, and the wheel O will be locked; or if any other part of the snail V, say 6, be opposite to the stud *z*, then the rack X will drop forward six notches, when the catch Y is raised; or if the part 12 of the snail V be opposite to the stud *z*, then the rack will drop forward twelve notches, consequently the clock will strike twelve.

53 and 54 are two levers, which turn on two studs 55 and 56; the studs are fixed in the plate *a a*; the lower ends of the levers are connected together by a small rod

57, forming a joint at each end with the levers, therefore the two levers must turn at the same time; 58 is a spring, one end of which is fixed to the plate *a a*, and the other acts against the edge of the lever 53, and presses the lower ends of the levers towards the left-hand side of the plate *a a*; 59 and 60 are two studs fixed in the plate *a a*, which limit the motion of the upper end of the lever 54; 61 and 62 are two arms, one of which is affixed to the detent or catch 22 of the quarter rack, and the other to the detent or catch Y of the hour rack, and against the ends of which act the ends of the levers: consequently if one end of a small wire or string be connected to either of the studs 63 or 64, (which are fixed in the ends of the levers), and the other end continued to the outside of the clock, or to any other part of a room where it may be easily got at in the dark, by pulling the string 65, the catches 22 and Y will be raised at the same instant, which will cause the clock to strike, first the quarters and then the hour.

Having fully described the several parts of the striking part of the clock, we shall now proceed to describe their actions on each other at different periods of the hour.

Suppose the clock has just struck twelve, the minute and hour hands will then be together; it will be observed that during the time the minute hand is advancing from one to fifteen, if the string 65 be pulled there will be no quarters to strike, but the hour twelve will be repeated; if we inspect the hour snail V at this period, we shall find the part 12 opposite the stud *z*, and if we examine the quarter snail, we shall find the side or arc *v* sliding against the stud 27, which prevents the stud from dropping, therefore no quarters will be struck; it must be also observed that when the minute hand has arrived at the tenth minute, the stud *r* (in the wheel S, which makes equal revolutions with the minute hand), will just begin to act against the trigger 25; when the stud *r* has arrived at the first dotted position (see fig. 1, plate XIV) The trigger will be bent into its first dotted position a'' and its shoulder will butt against the end of the arm 24, and prevent it from bending any further; therefore when the stud *r* has arrived at the second dotted position, the minute hand will be at the first quarter or fifteenth minute, the point of the trigger will be raised to the second dotted position a''', together with the arm 24, and the catch 22 to the first dotted position; the catch will then just clear the point of the tooth of the quarter rack Z; the arc *v* of the quarter snail will then have passed the stud 27 and admit it to drop on the arc v', (which makes an angle equal to one tooth of the rack,) consequeutly the rack will have moved one tooth forward, together with the detent or stud 30, which will release the gathering pallet 28; therefore as the pallet begins to turn, it raises the end of the lever 31, together with the stud 33, which acts against the under edge of the arm of the catch, and when the pallet just clears the point of the lever; the point of the catch 22, and the arm 24, will be raised up to the second dotted position, and the point a''' of the trigger will be raised above the stud *r* to the third dotted position; therefore as the point of the trigger just clears the stud *r*, the spring 26, which is upon the upper edge of the arm 24, presses the point of the trigger 25 inwards, and when the pallet has turned half round, the catch 22 will drop into the fifth notch of the rack, the pallet will then gather up the fourth tooth, and the catch will drop into the sixth notch, when the tail of the pallet will be locked against the detent or stud 30; it must also be observed, while the pallet, &c. is turning round, the wheel H turns the barrel wheel P one-fifth round, consequently one of the five pins *k k*, &c. which is fixed in the barrel, will act against the tail of the hammer *p* and cause it to strike the bell Q once, which is the first quarter past twelve, but the hour twelve will not be repeated, unless the string 65 be pulled, then it will first strike the quarter, and then the hour twelve. The use of the joint of the trigger 25 will be further observed here, by inspecting fig. 1, plate 2, viz. when the trigger was in the third dotted position, the spring 26 which acts on the upper edge, had pressed the point a'''' of the trigger inwards, consequently as the catch 22 descends the point a'''' of the trigger will clear the stud *r*, and rest in the lowest position a' ready for the next stud r' to act upon. But if there were no joint in the trigger 25, when the catch 22 descends, the point a''' of the trigger would drop again on the stud *r* as represented in the second dotted position, which would prevent the catch 22 from dropping into a notch of the rack Z, and would cause the clock to continue striking till the stud *r* had cleared the point of the trigger, which would be more than a minute.

When the minute hand has arrived at the thirtieth minute, the are v'' will be opposite to the stud 27, which will admit the rack Z to drop two notches, consequently two quarters will be struck; and when the minute hand has arrived at the forty-fifth minute, the side or arc v''' of the quarter snail will be opposite to the stud 27, the stud

r'' will raise the trigger 25, the hour rack will then drop forward three notches, which will admit the clock to strike the three quarters.

But when the minute-hand has arrived at the fifty-second minute, the stud w, which is fixed in the front of the quarter snail v, acts against the lower edge of one of the teeth of the star wheel U, and when the minute hand has arrived at the fifty-eighth minute, the stud w will have moved the star wheel U one tooth forward; then the side or arc 1 of the hour snail V will be opposite to the stud z; the notch v'''' in the quarter snail will then be opposite the stud 27, and when the minute hand has arrived at the sixtieth minute, the stud r''' will have raised the trigger 25, together with the catch 22, out of the notch Z of the quarter rack; the stud 27 will then drop to the bottom of the notch v''''; the end 44 of the rack will strike the tail of the hour catch Y, and raise the other end of it out of the notch 1$'$ of the hour rack; the detent 15 will be raised above the stud 17, till it stops against the top of the hole 16, then the wheel O will turn till the pin 19 stops against the detent 15; the stud z will then drop against the arc 1 of the hour snail V; the hour rack X will move forward one tooth; the rack Z will have moved forward four teeth; the clock will then strike the four quarters; but when it is striking the last quarter, the stud 42 draws up the tail of the tumbler; the stud 14 will then pass the corner 38 of the tumbler; the catch Y will drop into the notch 1$''$; the detent 16 will then be clear of the studs 17 and 19, which are fixed in the wheel O; the pallet 18 will then turn round and gather up one tooth of the hour rack, consequently the hammer 51 will strike the hour bell once, which will be one o'clock.

The rest of the hours will be a repetition of the same movements already described.

Reference to the figures in plate XIV.

Fig. 1 is a front view of the detent or catch 22, &c. shown in four positions, as already described.

Fig. 2 is a view of the upper edge of fig. 1, with the spring 26 removed. The back part of the shoulder of the studs, that is, the part adjoining the screwed end, is screwed against the face of the front part of the frame or plate *a a* both in this and the following figures; therefore, the projection of each part from the face of the plate *a a* will be easily ascertained, and also the thickness of each part.

Fig. 3 is a view of the upper side of spring 26.

Fig. 4 is a view of the upper edge of the lever 31, the front view of which is represented in its place behind the catch in fig. 1.

Fig. 5 is a front view, and

Fig. 6 is a view of the upper side of the quarter rack z, and the stud 20.

Fig. 7 is a front, and

Fig. 8 a side view of the hour rack X, and the stud W.

Fig. 9 is a front view, and

Fig. 10 a view on the upper edge of the detent or catch Y, and its stud 13.

Fig. 11 is a front view, and

Fig 12 a view of the upper side of the star wheel U, the hour snail V, and the stud *y*.

Fig 13 is a front view, and

Fig. 14 a view of the upper side of the wheel R, the quarter snail *v*, the hour wheel T, and the front part of the axis of the centre wheel C.

Fig. 15 is a front view, and

Fig. 16 a view of the upper side of the stud wheel S, the hour pinion *s*, and the stud *q*, on which they turn.

No. XVII.

PORTABLE BRIDGE OF SUSPENSION.

The GOLD VULCAN MEDAL was this session voted to COLIN SHAKESPEAR, Esq., postmaster-general, Calcutta, for his Portable Rope Bridge of Suspension. The following communication was received on the subject; and a model of the bridge has been placed in the Society's repository.

SIR, Kentish-Town, October 13, 1824.

IN consequence of the personal interview I was honoured with by you, I beg leave, by the desire of Mr. Colin Shakespear, of the Bengal Civil Establishment, to present to the Society of Arts, Manufactures, and Commerce, a model of a rustic portable rope bridge of tension and suspension, which has been introduced into use in India with acknowlenged benefit and advantage to the public service.

The description and other papers which accompany the model, Mr. Shakespear trusts will establish this fact, and encourage him to hope that the advances he has made in the construction of the bridge of which this is the model,